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Need To Assess The Impact Of Surface Water Bodies For Sustainable Urban Development

Ar. Gautami Bura[1], Dr. Parag Govardhan Narkhede[2]
[1]Architect, M.Arch, gautamibura@gmail.com
[2]H.O.D. at BKPS College of Architecture, Pune, parag@bkps.edu

Abstract:
Surface water bodies are an essential part of the green-blue infrastructure that is directly related to the development of the city. Urban cities have these water bodies as a natural source of water or created artificially. Surface water bodies in urban areas include lakes, rivers, ponds, wetlands and canals. We are not considering ocean or sea, as these have a different characteristic that freshwater sources. We have been studying that civilization started at the banks of a river or lake due to basic necessity of using water for human activities. Water is life for human, nature and animals as well. Today we have developed so much that water can be carried from far away and supplied to our homes in every corner of the city. However, the water bodies are being polluted by discharge of sewage, pollutants and improper planning. Due to these activities, the water bodies have polluted so much that they have lost aquatic life and is causing negative effects to the environment. In earlier studies, when calculating the amount of oxygen released and carbon dioxide absorbed, surface water bodies are proven to be more capable than trees and forest. Today we face climate change and by the United Nations Sustainable Development Goals, we aim to achieve improvement in climate change. Climate change is caused by a number of reasons and not only one issue. But, only focusing on what is causing the problem will not solve the issue; focusing on how the issue can be solved is equally important. The nature solves its problems itself. The only requirement is to leave it undisturbed and maintain its original state. The research study aims to find out the importance of surface water bodies – its positive and negative impacts, current scenario and future directions that will benefit in Sustainable Urban Development. The study includes a comprehensive study and survey of literature, articles, finding research gaps and scholarly publications. The paper analyses the impact of surface water bodies and concludes with important research gaps providing directions to future research.
Keywords: *urban, sustainability, water bodies, development*

INTRODUCTION:

Urbanization has led a huge rise in critical issues such as over population, excessive demand of resources and services, lack of fertile land, exploitation of natural resources, increase in pollution, poor air quality, degradation of forests and land and many more. The adverse effects of urbanization cannot be ignored today. In India, urban areas are facing flooding every year. Due to increased concrete surfaces, the water does not seep into the ground thus increasing stormwater runoff. Rainfall occurs at anytime throughout the year, which destroys water supply and drainage system, farming activities and disrupts the ecological balance. The water management of urban areas is not sufficient to handle water issues. Surface water bodies that are present in urban areas have to face these challenges. Sudden increase in water levels from stormwater happens and the drainage system ends up into these water bodies. Many times, urban areas also face water scarcity, not only in municipal water supply but also the groundwater resources get exhausted. Blue infrastructure planning is a network of these water supply and drainage systems. These connect natural and artificial systems into a comprehensive network that should benefit human, animals and nature. These surface water bodies are a part of blue infrastructure planning, they can be man-made or natural, temporary or permanent, large scale or small scale. It doesn't matter how the physical shape of the surface water is, surface water bodies have far more potential than how it being currently utilized. Surface water bodies, if maintained and enhanced, they will act as a nature-based solution for blue infrastructure challenges.

Surface water bodies are ecosystem services that support local biodiversity. Nature works in a cycle, if any one is disrupted, then the whole ecosystem collapses. Similarly, when the surface water bodies are polluted, the biodiversity depended on it starts to decline. Eventually, it completely loses its ecosystem. Adverse effects of depleted ecosystem are seen at local to global level. Thus, surface water bodies acts as

both a victim and solution to the climate crisis that we face today. A well-planned blue infrastructure is beneficial for the positive development of a city and at global scale it makes a huge difference.
Aim: To study the impact of surface water bodies for Sustainable Urban Development.
Objective:

- To study sustainable urban development and its relevance with surface water bodies
- To analyse research gaps in existing literature related to surface water bodies in urban areas and sustainable urban development
- To provide guidelines for future research studies

METHODOLOGY:

The methodology of this paper includes study of surface water bodies which consists of properties, key role in nature, connection with environment, challenges and current situation. Study of sustainable urban development is done with in-depth analysis of green blue infrastructure and special focus on its connection with surface water bodies. To conduct this analysis, a systematic review of existing literature such as scholarly articles, websites, blogs, books, research reports, news and research papers. The papers were selected on the basis of following keywords; blue infrastructure, surface water bodies, ecology, water bodies, urban, urban planning, climate change and sustainable development. Out of these, the papers with original data collection and papers published after the year 2018 were selected.

LITERATURE REVIEW:

A paper by Kumar Vishwakarma, et.al., have done research study on stormwater drainage systems of the major six cities of India namely; Delhi, Mumbai, Chennai, Varanasi, Chandigarh, and Roorkee. (Vishwakarma, et.al., 2023) The purpose of the study was to evaluate the sustainability of drainage systems by sustainable indices. The indices used were; Natural Drainage System Index, Drainage Coverage Index, Water Logging Index and Water Body Vulnerability Index. The assessment was done by use of remote sensing and GIS. As the study included both Tier I and II cities, Chandigarh was proven highest in sustainability score while Delhi, Mumbai and Chennai have the poorest sustainability score. The study suggests improvements in restoration and rejuvenation of water bodies, increase in permeable surface area, increase in stormwater storage and treatment infrastructure and better master planning and technology upgrades.
A paper by D. R. Manjunath and P. Jagadeesh suggests water analysis and improvement strategies to align with the SDG goals of 6.4 and 13.3. The research study analyses the interlinkage of temperature and water quality in urban lakes of Vellore city, Tamil Nadu. By use of satellite data, land use and surface temperature were assessed to find out the impacts of urban lakes in the surroundings. (Manjunath, et.al. 2024). Water quality index was developed and analysed with these parameters to find out research gaps, strategies and issues. The study collected data of these parameters for analysis of degradation, emerging issues, challenges and restorative strategies. Increasing the vegetation by 10-20% restores the water body by 2-5%. This mitigates thermal stress and preserves the surrounding environment and ecology. I another research study done by same authors, the research aimed to address critical gaps in the land use land cover changes that impact the land surface temperature, urban heat island effect and water spread areas in the city of Vellore. The analysis was done based on urban planning which helps in predicting the impacts and gives accurate data of area wise distribution. The study showed significant increase in built-up area and reduction of water surface area causing decline in vegetation and agricultural practices. (Manjunath, et.al. 2025). Water bodies and vegetation reduce the temperature in the vicinity and dense built-up areas have higher temperatures. To cater this issue, zoning regulations and restoration of wetlands is essential. Creating artificial water bodies is also required to maintain comfortable conditions. As water surface area increases, it supports the vegetation and both act as a nature-based solution for urban climate crisis. Community awareness shall help in spreading the knowledge and importance.

Sustainable Urban Development

Sustainable Urban Development of a city is a process of developing a city in such a way that provides adequate services to residents while minimizes negative impact on the environment, providing for a better future. Sustainable Urban development includes sustainability in social, economic, environmental and

ecological growth of a city. The problem of the world is urbanization. (U.S.-China CSU, 2017). The solution to this problem, is also urbanization, but in a sustainable approach. We need to change the way urban cities are growing; such as compact forms, unplanned settlements, ratio of natural features to built structures, ratio of land per person available, resources utilized, waste management and mobility.

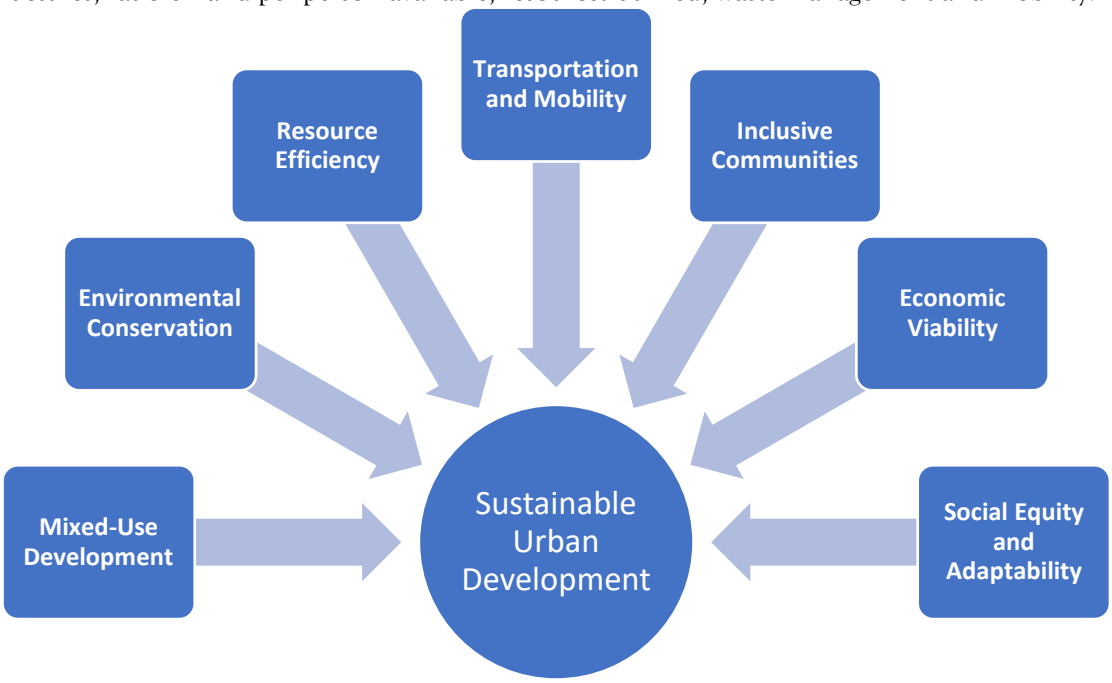

Figure 1: Parameters that lead to efficient Sustainable Urban Development

To ensure sustainable urban development, policies such as the United Nations Sustainable Development goals (2015) was introduced. In this mission, the targets of Sustainable Development Goals must be achieved by the year 2030. The goal number 11 which is 'Make cities and human settlements inclusive, safe, resilient and sustainable'. This goal is connected to sustainable Urban Development. There are 7 targets under this goal, all of these targets support the idea of Sustainable urban Development.

India, has also committed to the contribution of Sustainable urban Development and SDG framework. The NITI Aayog (National Institution for Transforming India), established in 2015, tracks state level progress, provides policies for long term guidance, and real time monitoring of government programs. This program also promotes green technologies, clean energy, climate resilience and economic sustainability. The smart cities mission also focuses on making new cities capable for metropolitan development and reduce the load on existing cities.

The challenges to sustainable development in India are high increase in population of urban areas which led to a rise of number of issues such as traffic congestion, slums, housing demand, inadequate open space, exploitation of natural resources, depletion of forest and agricultural land, severe air and water pollution, waste management, water supply and drainage systems, infrastructure gaps, poverty and unemployment, depletion of fossil fuels and inadequate supply of electricity. Strong policies may exist but implementation guidelines are required. To carry out ground work, the issues must be solved at grassroot level. By working on parts and increasing day by day, sustainable development becomes possible and complete in a big span of time. Research data is required to carry out ground level work in India. Sustainable urban development directly benefits for India's contribution to the global goals of Climate change and Net zero Agenda.

Surface Water bodies: Overview, Challenges and Impacts

Surface water bodies include: Wetlands, Ponds, Lakes, rivers and canals. These are either running water or stagnant. (Hellman et.al., 2020) Surface water bodies have a magnificent aquatic life under the water. Aquatic animals regulate the water quality, depend on food chain and plants present under the water. Planktons are also the part of the food chain on aquatic life. Planktons are capable to absorb carbon dioxide in huge amount as well as release oxygen into the air. The surface water bodies are thus capable to maintain good air quality in the vicinity. Birds, land animals and humans also depend on these surface

water bodies for food, nutrition, drinking water and life. Thus, water bodies are an important component of the urban ecosystem. Due to unlimited exploitation of these water bodies, the water life has depleted drastically. Direct drainage lines are released into the water streams without treatment. Chemicals, oils and other solid waste are dumped into the rivers and lakes in urban areas. A water body has a capacity to cleanse itself at a certain limit which is depended on the BOD, COD and DO levels of the water. (Kankal, et.al., 2012). However, due to excessive dumping of wastage, the limit has exceeded and now the water is not at all capable to naturally cleanse the impurities. The sewage treatment plants are present in the cities but the amount of discharge released exceeds the capacity of STP to treat the waste water.

The challenges of surface water bodies in urban areas are the increasing rate or urbanization and lack of green blue infrastructure planning. Relesase of untreated wastewater has increased rapidly in Indian cities. This causes polluted water reaching to the agricultural fields in the rural areas. Such water used for agriculture is hazardous. A large number of dumping non-biodegradable waste into the water bodies has significantly increased. This waste ends up in the water bodies for many years and causes water borne diseases. Urban construction and encroachment are also some challenges that reduce the storage capacity of a water body causing urban flooding. (Bahadur, N., et.al., 2023)

Impacts of depletion in surface water bodies rises to a number of issues. Broadly we can classify that the impacts are affected to:

- Human Health
- Environment
- Ecology
- Drinking Water Supply
- Socio-economy
- Groundwater resources
- Community and culture
- Agriculture
- Climate

The depletion of India's surface water bodies affects human health because, polluted water is more prone to develop harmful bacteria, severe disease mosquitos and other diseases such as cholera, typhoid, and infections. These diseases spread on people living near the water bodies as well poor people using the water for various activities. When aquatic habitats are destroyed, biodiversity is lost, and native species that depend on rivers, lakes, and wetlands disappear, ecology is harmed. (Pukowiec-Kurda, K., 2022).

As rivers and lakes get polluted, it becomes harder for people who live in rural and peri-urban areas, to get clean and affordable drinking water. The social and economic factors such as fishing, people using water bodies for recreational activities and the tourism is affected due to water pollution. Groundwater resources also get exhausted because the loss of surface water bodies means less natural recharge. This leads to deeper extraction and aquifer depletion. Many surface water bodies have religious, spiritual, and social meaning for the community. When they are damaged, traditions and identity are lost.

In farming, less surface water makes it harder to irrigate, which means farmers have to rely on groundwater that isn't sustainable and crops don't grow as well. Finally, the climate is affected because the loss of water bodies raises local temperatures, lowers humidity, and changes the microclimate, making areas more prone to both floods and droughts. All of these effects show how important it is to protect and manage surface water bodies in a way that is beneficial for all.

DISCUSSION

From the above theoretical and systematically literature review, a few gaps of research are found. The importance of surface water bodies is very high that it cannot be neglected. It affects the social, economic, environmental, ecological and human health factors of an urban city. Various studies showed the need of blue infrastructure planning, global level and national level policies, impacts and solutions to most of the issues of urban cities. The studies also recommended more data collection and in-depth study of surface water bodies in Urban areas. Research studies recommend need of policies, urban design strategies and customised solutions for maintaining and restoring surface water bodies in urban areas. It is highly

recommended to asses all the surface water bodies in terms of ecology, environment, social, economic, health and sanitation and cultural significance for sustainable urban development. Assessment in terms of field survey, data collection and satellite mapping will help provide better solutions and develop policies that promote sustainable urban development.

Green Blue infrastructure planning has opened many new viewpoints towards climate crisis and achieving the global goals as well as national level goals. By studying surface water bodies in detail, the abundance of water life is important, urban issues such as urban heat island effect, poor air quality, air pollution and stormwater management can be solved by merely a simple solution. Urban areas have great potential to become a sustainable urban city, if planned properly, and restored with balance. Sustainable urban development is a broad topic and a goal that requires many solutions. Out of which one of the solutions is green-blue infrastructure. Nature works with a complete cycle, thus only planting trees and recreational spaces does not help in proper planning. It requires water bodies as a support to vegetation and biodiversity that completes the whole cycle.

CONCLUSIONS

The research study throws light towards a special focus on surface water bodies, their impacts and as a nature-based solution for sustainable urban development. This research study provides new directions to researchers, academicians and policy planners for planning better solutions. A theoretical and systematically review helps in overall understanding, identifying gaps, connecting linkages between two topics and providing future research recommendations.

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